

WHAT IS CLAIMED IS:

- 1 1. An apparatus, comprising:
 - 2 a) a micro machined optical element; and
 - 3 b) a magnetic sensor disposed on the micro machined optical element.
- 1 2. The apparatus of claim 1 wherein the magnetic sensor senses a magnetic field
2 that is used to actuate the micro machined optical element.
- 1 3. The apparatus of claim 1 wherein the micro machined optical element includes
2 a moveable portion and at least one magnetic sensor disposed on the moveable
3 portion.
- 4 4. The apparatus of claim 3 wherein the at least one magnetic sensor includes a
5 sensor selected from the group consisting of , magneto resistive sensors, giant
6 magnetoresistance sensors, colossal magnetoresistance sensors, anisotropic
7 magnetoresistance sensors, magnetic tunnel junction devices, Hall effect
8 sensors, flux sensing coils, magnetostriction sensors and magneto optic
9 sensors.
- 1 5. The apparatus of claim 3 wherein the micro machined optical element includes
2 a fixed portion and at least one sensor further includes one or more magnetic
3 sensors disposed on the fixed portion.
- 1 6. The apparatus of claim 5 wherein the magnetic sensor disposed on the fixed
2 portion is disposed on a sidewall of the fixed portion.
- 1 7. The method of claim 5 wherein the fixed portion includes a base and the
2 magnetic sensor that is disposed on the fixed portion is disposed on the base.
- 1 8. The apparatus of claim 5 wherein the fixed portion includes a top chip and the
2 sensor is disposed on the top chip.
- 1 9. The apparatus of claim 5 wherein the sensor that is disposed on the movable
2 portion and the sensor that is disposed on the fixed portion are electrically
3 coupled in a bridge circuit.

- 1 10. The apparatus of claim 9 wherein the bridge circuit is a Wheatstone bridge
2 circuit.
- 1 11. The apparatus of claim 1 wherein the magnetic sensor senses a sense magnetic
2 field that is separate from a magnetic field that actuates the micro machined
3 optical element.
- 1 12. The apparatus of claim 11, wherein a magnetic structure disposed on the micro
2 machined optical element creates or changes the magnitude or direction of the
3 sense magnetic field.
- 1 13. The apparatus of claim 12, wherein the at least one magnetic sensor is selected
2 from the group consisting of , magneto resistive sensors, giant
3 magnetoresistance sensors, colossal magnetoresistance sensors, anisotropic
4 magnetoresistance sensors, magnetic tunnel junction devices, Hall effect
5 sensors, flux sensing coils, magnetostriction sensors and magneto optic
6 sensors.
- 1 14. The apparatus of claim 12 wherein the at least one magnetic sensor includes
2 two or more magnetic sensors.
- 1 15. The apparatus of claim 14 wherein the two or more sensors are coupled
2 together in a bridge circuit.
- 1 16. The apparatus of claim 15 wherein the bridge circuit is a Wheatstone bridge
2 circuit.
- 1 17. The apparatus of claim 12 wherein the micro machined optical element
2 includes a moveable portion wherein the moveable portion is moveable with
3 respect to an axis.
- 1 18. The apparatus of claim 17 wherein the magnetic material is disposed
2 substantially parallel to the axis.
- 1 19. The apparatus of claim 18 wherein the at least one sensor includes a
2 magnetoresistive sensor;
3 wherein the magnetoresistive sensor has a “C” shape having a gap;

- 4 wherein, in at least one position of the moveable element, the magnetic
5 material is disposed within the gap.
- 6 20. The apparatus of claim 17 wherein the magnetic material is disposed
7 substantially perpendicular to the axis.
- 1 21. The apparatus of claim 20 wherein the at least one sensor includes a
2 magnetoresistive sensor;
3 wherein the magnetoresistive sensor has a “C” shape having a gap;
- 4 22. The apparatus of claim 21 wherein, in at least one position of the moveable
5 element, the magnetic material is disposed within the gap.
- 1 23. The apparatus of claim 12 wherein the at least one magnetic sensor includes a
2 magnetoresistive sensor characterized by a serpentine shape.
- 1 24. The apparatus of claim 1, further comprising:
2 means for measuring a temperature; and
3 means for compensating for a change in the property of the at least one
4 magnetic sensor with temperature.
- 1 25. The apparatus of claim 24, wherein the compensating means includes means
2 for determining a relationship between the property of the magnetic sensor and
3 the measured temperature.
- 1 26. The apparatus of claim 24, wherein the compensating means includes means
2 for regulating the temperature to maintain the temperature within a desired
3 range.
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